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Proposed Re-evaluation Decision PRVD2014-07

1,4-Bis(bromoacetoxy)-2-butene

(publié aussi en français)

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Overview

What Is the Proposed Re-evaluation Decision?

After a re-evaluation of the antimicrobial active ingredient 1,4-bis(bromoacetoxy)-2-butene, also referred to as BBAB (mixed bromoacetic acid esters of 2-butene-1,4-diol), Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing continued registration of products containing 1,4-bis(bromoacetoxy)-2-butene for sale and use in Canada.

An evaluation of available scientific information found that products containing 1,4-bis(bromoacetoxy)-2-butene do not present unacceptable risks to human health or the environment when used according to the revised label directions. As a condition of the continued registration of 1,4-bis(bromoacetoxy)-2-butene uses, new risk-reduction measures are proposed to be included on the labels of all products. No additional data are being requested at this time.

This proposal affects all end-use products containing 1,4-bis(bromoacetoxy)-2-butene registered in Canada. Once the final re-evaluation decision is made, the registrant will be instructed on how to address any new requirements.

This Proposed Re-evaluation Decision is a consultation document[1] that summarizes the science evaluation for 1,4-bis(bromoacetoxy)-2-butene and presents the reasons for the proposed re-evaluation decision. It also proposes additional risk-reduction measures to further protect human health and the environment.

The information is presented in two parts. The Overview describes the regulatory process and key points of the evaluation, while the Science Evaluation provides detailed technical information on the assessment of 1,4-bis(bromoacetoxy)-2-butene.

The PMRA will accept written comments on this proposal up to 45 days from the date of publication of this document. Please forward all comments to Publications (please see contact information indicated on the cover page of this document).

What Does Health Canada Consider When Making a Re-evaluation Decision?

The PMRA's pesticide re-evaluation program considers potential risks, as well as value, of pesticide products to ensure they meet modern standards established to protect human health *and* the environment. Regulatory Directive DIR2001-03, *Pest Management Regulatory Agency Re-evaluation Program*, presents the details of the re-evaluation activities and program structure.

The proposed re-evaluation decision for 1,4-bis(bromoacetoxy)-2-butene takes into consideration previous PMRA and available United States Environmental Protection Agency assessments for

[1] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

this active ingredient. For more details on the information presented in this overview, please refer to the Science Evaluation of this consultation document.

What is 1,4-Bis(bromoacetoxy)-2-butene

1,4-Bis(bromoacetoxy)-2-butene, also referred to as BBAB (mixed bromoacetic acid esters of 2-butene-1,4-diol), is a broad-spectrum antimicrobial active ingredient used for control of slime-forming bacteria and fungi in pulp and paper mills. The commercial end-use product containing 1,4-bis(bromoacetoxy)-2-butene can be added to the process water used in the production of pulp and paper via a metered pump (considered to be a closed mixing/loading system).

Health Considerations

Can Approved Uses of 1,4-Bis(bromoacetoxy)-2-butene Affect Human Health?

1,4-Bis(bromoacetoxy)-2-butene is unlikely to affect your health when used according to the revised label directions.

Workers can be exposed to 1,4-bis(bromoacetoxy)-2-butene when applying the product during the paper manufacturing process and/or through contact with pulp and paper. Individuals in residential settings can be exposed to 1,4-bis(bromoacetoxy)-2-butene through contact with finished paper products. 1,4-Bis(bromoacetoxy)-2-butene is not registered for use on food and/or feed crops and it is not allowed for use in the production of food contact paper products. Dietary exposure from food and drinking water is not anticipated under current conditions of use.

The risk for workers and the general public exposed to 1,4-bis(bromoacetoxy)-2-butene and/or its transformation products (bromoacetic acid and butane diol) is not of concern based on the current Canadian use pattern, revised conditions of use, and low anticipated residue levels in pulp and paper products. Given the corrosive nature of 1,4-bis(bromoacetoxy)-2-butene, additional personal protective equipment is proposed for workers handling the commercial end-use product, and for those coming in contact with the treated process water or involved in clean-up, maintenance, and repair activities at pulp and paper mills.

Environmental Considerations

What Happens When 1,4-Bis(bromoacetoxy)-2-butene is Introduced into the Environment?

1,4-Bis(bromoacetoxy)-2-butene is unlikely to affect non-target organisms when used according to the revised label directions.

Given the registered use pattern and current conditions of use, the potential for environmental exposure to 1,4-bis(bromoacetoxy)-2-butene is considered to be low. An update of the existing environmental label statements to current standards is proposed.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human health and the environment. These directions must be followed by law. As a result of the re-evaluation of 1,4-bis(bromoacetoxy)-2-butene, the PMRA is proposing further risk-reduction measures for product labels.

Human Health

To protect workers handling the commercial product, coming in contact with the treated process water or involved in clean-up, maintenance, and repair activities at pulp and paper mills: additional personal protective equipment.

Environment

Update of the existing environmental label statements to current standards.

A submission to implement label revisions will be required within 90 days of finalization of the re-evaluation decision.

Next Steps

Before making a final re-evaluation decision on 1,4-bis(bromoacetoxy)-2-butene, the PMRA will consider all comments received from the public in response to this consultation document. The PMRA will then publish a Re-evaluation Decision[2] that will include the decision, the reasons for it, a summary of comments received on the proposed decision and the PMRA's response to these comments.

[2] "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Science Evaluation

1.0 Introduction

1,4-Bis(bromoacetoxy)-2-butene, also referred to as BBAB (mixed bromoacetic acid esters of 2-butene-1,4-diol), is a broad-spectrum antimicrobial active ingredient (a.i.) registered in Canada for control of slime-forming bacteria and fungi in pulp and paper mills.

In Canada, 1,4-bis(bromoacetoxy)-2-butene was first registered in 1980 and, therefore, is subject to re-evaluation according to Regulatory Directive DIR2001-03, *Pest Management Regulatory Agency Re-evaluation Program*.

Following the re-evaluation announcement for 1,4-bis(bromoacetoxy)-2-butene, the registrant of the technical grade active ingredient in Canada indicated their intention to provide continued support for the currently registered use.

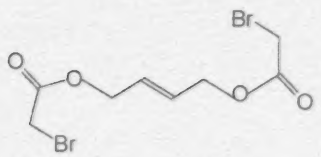
The purpose of this re-evaluation is to review existing information on the active ingredient, 1,4-bis(bromoacetoxy)-2-butene, and the currently registered technical and commercial class end-use products containing this active ingredient, to determine whether, and under what conditions, the continued registration of these products is acceptable.

The current re-evaluation of 1,4-bis(bromoacetoxy)-2-butene takes into consideration previous Pest Management Regulatory Agency (PMRA) and available United States Environmental Protection Agency assessments for this active ingredient.

2.0 The Technical Grade Active Ingredient and Its Properties and Uses

2.1 Identity

Common name	Bis (bromoacetoxy)butane
Function	Microbicide
Chemical Family	Ester
Chemical name	
1 International Union of Pure and Applied Chemistry (IUPAC)	2-butene-1,4-diol bis(bromoacetate)
2 Chemical Abstracts Service (CAS)	1,4-Bis(bromoacetoxy)-2-butene

CAS Registry Number	20679-58-7
Molecular Formula	$C_8H_{10}Br_2O_4$
Structural Formula	
Molecular Weight	330
Purity of the Technical Grade Active Ingredient	BBAB (Mixed bromoacetic acid esters of 2-butene-1,4-diol) at 95%

Based on the manufacturing process used, impurities of human health or environmental concern as identified in the Canada Gazette, Part II, Vol. 142, No. 13, SI/2008-67 (2008-06-25), including TSMP Track 1 substances, are not expected to be present in the product.

The guarantee expression on the commercial end-use product label is proposed to be updated to match the current Statement of Product Specification Form. The proposed label amendments are listed in Appendix II.

2.2 Physical and Chemical Properties

Property	Result	Interpretation
Vapour pressure at 20°C	1.59×10^{-6} torr (2.11×10^{-4} Pascal)	Low volatility
Ultraviolet (UV)/visible spectrum	Not expected to absorb at $\lambda > 300$ nm	Phototransformation is unlikely
Solubility in water	0.0630 g/100mL	Soluble in water
***n*-Octanol–water partition coefficient, log K_{ow}**	log K_{ow} = 1.7	Bioaccumulation is unlikely

2.3 Description of Registered 1,4-Bis(bromoacetoxy)-2-butene Uses

Currently registered products containing 1,4-bis(bromoacetoxy)-2-butene are listed in Appendix I.

The use of 1,4-bis(bromoacetoxy)-2-butene for control of bacterial and or fungal slime in pulp and paper mills is supported by the registrant and was, therefore, considered in the re-evaluation of 1,4-bis(bromoacetoxy)-2-butene.

The commercial end-use product containing 1,4-bis(bromoacetoxy)-2-butene, formulated as an 80% solution, can be applied to the process water used in the production of pulp and paper via a metered pump (considered to be a closed mixing/loading system) either continuously or intermittently at the rate of 94 parts per million in the paper produced.

3.0 Human Health

Toxicology studies in laboratory animals describe potential health effects resulting from various levels of exposure to a chemical and identify dose levels at which no effects are observed. Unless there is evidence to the contrary, it is assumed that effects observed in animals are relevant to humans and that humans are more sensitive to effects of a chemical than the most sensitive animal species.

Exposure to 1,4-bis(bromoacetoxy)-2-butene may occur while applying the pesticide in pulp and paper mills and/or through contact with pulp and/or paper products.

3.1 Toxicology Summary

The technical grade 1,4-bis(bromoacetoxy)-2-butene was found to be moderately acutely toxic via the oral route of exposure and non-toxic via the dermal route of exposure. The active was a severe skin irritant and was classified as an eye irritant based on its corrosive nature. The acute inhalation study was waived based on the corrosive nature of the active ingredient. The required hazard warning label statements are included on the current end-use product label. The use of a metering pump (considered to be a closed mixing/loading system) and a cartridge respirator if the area is not well ventilated and during clean-up, maintenance and repair activities, is required on the current product label. To protect pulp and paper mill workers involved in mixing/loading, clean-up, maintenance and repair, or those coming in contact with the treated process water, additional personal protective equipment consisting of chemical resistant coveralls over a single layer of clothing, chemical resistant gloves, protective eyewear (goggles or face shield) is further proposed based on the skin and eye irritation properties of this active ingredient. The proposed label amendments are listed in Appendix II.

In the available oral toxicity studies with 1,4-bis(bromoacetoxy)-2-butene, the primary treatment-related effects included irritative/corrosive effects on the stomach, an increased salivation prior to and post dosing, hypoactivity, anemia, decrease mean body weights, body weight gains, and food consumption. No treatment-related teratogenic effects were observed.

The potential for occupational and residential exposure to 1,4-bis(bromoacetoxy)-2-butene and/or its transformation products (bromoacetic acid and butane diol) is considered to be limited given the Canadian use pattern (pulp and paper mills only), revised conditions of use (additional personal protective equipment for pulp and paper mill workers), and low residue levels of the parent compound and/or its transformation products anticipated in pulp and paper products (due to a low application rate, a significant dilution during the manufacturing process, and the removal of residues with water during the paper manufacturing process). No toxicological

endpoints of concern were established by the PMRA for 1,4-bis(bromoacetoxy)-2-butene risk characterization at this time.

There are data gaps in the existing database for 1,4-bis(bromoacetoxy)-2-butene, however, given a limited potential for exposure, no data are required at this time. Additional data may be required if a request for expansion of the use pattern is received.

3.2 Occupational Exposure and Risk

Workers can be exposed to 1,4-bis(bromoacetoxy)-2-butene when applying the pesticide during the paper manufacturing process and/or through contact with pulp or paper.

3.2.1 Chemical Handler Exposure and Risk

In industrial settings, 1,4-bis(bromoacetoxy)-2-butene can be added to the process water used in the production of pulp and paper via a metered pump (considered to be a closed mixing/loading system). Exposure to 1,4-bis(bromoacetoxy)-2-butene from its use in industrial settings is expected to be intermittent over an intermediate to long-term duration, predominately via the dermal route.

Overall, the risk for workers applying the pesticide using closed mixing/loading systems is not expected to be of concern given the limited potential for exposure under the revised conditions of use (additional personal protective equipment requirement). The label statement requiring the use of a metering pump system is already included on the current product label under "Directions of Use" section.

The proposed label amendments are listed in Appendix II.

3.2.2 Postapplication Exposure and Risk

There is a potential for postapplication inhalation and/or dermal exposure of workers in pulp and paper mills. However, taking into consideration low residue levels of the parent compound and/or its transformation products anticipated in pulp and paper products (due to a low application rate, a significant dilution during the manufacturing process, and the removal of residues with water during the paper manufacturing process), the risk for postapplication workers is not expected to be of concern.

Based on qualitative risk assessments, there are no concerns for workers exposed to 1,4-bis(bromoacetoxy)-2-butene. No additional exposure data are required.

3.3 Non-occupational Exposure

In Canada, there are no domestic-class products containing 1,4-bis(bromoacetoxy)-2-butene. There is, however, a potential for dermal exposure of the general population to the pesticide residues in finished paper products.

3.3.1 Residential Exposure and Risk

The postapplication dermal risk for the general population is not expected to be of concern given low residues of 1,4-bis(bromoacetoxy)-2-butene and/or its transformation products anticipated in finished paper products (due to a low application rate, a significant dilution during the manufacturing process, and the removal of residues with water during the paper manufacturing process), as well as a low likelihood of continuing exposure to paper products containing 1,4-bis(bromoacetoxy)-2-butene.

3.3.2 Residue Limits in Food Commodities

In Canada, 1,4-bis(bromoacetoxy)-2-butene is not registered for food or feed use. There are no Canadian Maximum Residue Limits (MRLs) established for 1,4-bis(bromoacetoxy)-2-butene.

3.3.3 Dietary Exposure and Risk

Dietary exposure to 1,4-bis(bromoacetoxy)-2-butene and its transformation products from food and drinking water is not anticipated in Canada under current conditions of use. 1,4-Bis(bromoacetoxy)-2-butene is not registered for use on food and/or feed crops and it is not allowed for use in the production of food contact paper products. Contamination of drinking water is not expected given a low potential for environmental exposure.

3.3.4 Aggregate Exposure and Risk

An aggregate exposure and risk assessment was not required for 1,4-bis(bromoacetoxy)-2-butene since there are no residential exposure scenarios and dietary exposure from food and water is not anticipated.

Based on qualitative risk assessments, there are no concerns for the general public exposed to 1,4-bis(bromoacetoxy)-2-butene. No additional exposure data are required.

3.3.5 Cumulative Exposure and Risk

The *Pest Control Products Act* requires that the PMRA consider the cumulative exposure to pesticides with common mechanism of toxicity. For the current re-evaluation, the PMRA concluded that 1,4-bis(bromoacetoxy)-2-butene does not share a common mechanism of toxicity with other pest control products.

4.0 Environment

1,4-Bis(bromoacetoxy)-2-butene was found to be highly toxic to aquatic organisms. The required hazard label statement is included on the current commercial product label.

1,4-Bis(bromoacetoxy)-2-butene has a low vapour pressure and, therefore, is expected to be non-volatile from water surfaces. It is not expected to bioaccumulate based on the log octanol-water coefficient factor of 1.7.

Following application to the process water in pulp and paper mills, 1,4-bis(bromoacetoxy)-2-butene is expected to degrade rapidly by hydrolysis. Bromoacetic acid and butane diol were identified as main hydrolytic products. Bromoacetic acid was found to further transform under neutral and alkaline conditions to form glycolic acid and hydrobromic acid, which were found to be of low toxicity to aquatic organisms. There are data gaps with regards to environmental fate and aquatic toxicity of butane diol.

Based on the registered use pattern, the potential for environmental exposure to the parent compound and its transformation products is considered to be low. The PMRA proposes to update the existing environmental label statements to current standards. The proposed label amendments are listed in Appendix II.

Given the limited potential for environmental exposure under current conditions of use, no additional data are being requested at this time, however, additional data may be required if a request for expansion of the use pattern is received.

5.0 Pest Control Product Policy Considerations

5.1 Toxic Substances Management Policy Considerations

The Toxic Substances Management Policy (TSMP) is a federal government policy developed to provide direction on the management of substances of concern that are released into the environment. The TSMP calls for the virtual elimination of Track 1 substances [those that meet all four criteria outlined in the policy: in other words, persistent (in air, soil, water and/or sediment), bioaccumulative, primarily a result of human activity and toxic as defined by the *Canadian Environmental Protection Act*).

During the re-evaluation process, 1,4-bis(bromoacetoxy)-2-butene was assessed in accordance with the PMRA Regulatory Directive DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy,* and evaluated against the Track 1 criteria. In order for 1,4-bis(bromoacetoxy)-2-butene to meet Track 1 criteria, the criteria for both bioaccumulation and persistence (in one media) must be met. The PMRA has reached the following conclusion:

- Persistence. 1,4-Bis(bromoacetoxy)-2-butene half-life in water is less than 1 day. Given that TSMP Track 1 criterion is ≥182 days in water it is concluded that 1,4-bis(bromoacetoxy)-2-butene does not meet the criteria for persistence.

- Bioaccumulation. The log octanol-water partition coefficient factor of 1.7 for 1,4-bis(bromoacetoxy)-2-butene was reported. Given that TSMP Track 1 criterion is ≥5.0 it is concluded that 1,4-bis(bromoacetoxy)-2-butene does not meet the criterion for bioaccumulation.

- 1,4-Bis(bromoacetoxy)-2-butene does not meet all Track 1 criteria and therefore is not considered a Track 1 substance.

5.2 Contaminants and Formulants of Health or Environmental Concern

During the re-evaluation of 1,4-bis(bromoacetoxy)-2-butene, contaminants in the technical are compared against the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* maintained in the *Canada Gazette*.[3] The list is used as described in the PMRA Notice of Intent NOI2005-01 and is based on existing policies and regulations including DIR99-03 and DIR2006-02, and taking into consideration the Ozone-depleting Substance Regulations, 1998, of the *Canadian Environmental Protection Act* (substances designated under the Montreal Protocol). The PMRA has reached the following conclusion:

- Technical grade 1,4-bis(bromoacetoxy)-2-butene does not contain any contaminants of health or environmental concern identified in the *Canada Gazette*.

The use of formulants in registered pest control products is assessed on an ongoing basis through PMRA formulant initiatives and Regulatory Directive DIR2006-02.

6.0 Incident Reports

Since 26 April 2007, registrants have been required by law to report incidents, including adverse effects to health and the environment, to the PMRA within a set time frame.

As of 17 March 2014, no reports of incidents have been reported to the PMRA for 1,4-bis(bromoacetoxy)-2-butene.

7.0 Organisation for Economic Co-operation and Development (OECD) Status

Canada is part of the Organisation for Economic Co-operation and Development (OECD), which groups 34 member countries and provides governments with a setting in which to discuss, develop and perfect economic and social policies.

As part of the re-evaluation of an active ingredient, the PMRA takes into consideration recent developments and new information on the status of an active ingredient in other jurisdictions, including OECD member countries. In particular, decisions by an OECD member to prohibit all uses of an active ingredient for health or environmental reasons are considered for relevance to the Canadian situation.

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[3] *Canada Gazette*, Part II, Volume 139, Number 24, pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* and in the order amending this list in the *Canada Gazette*, Part II, Volume 142, Number 13, pages 1611-1613. *Part 1 Formulants of Health or Environmental Concern, Part 2 Formulants of Health or Environmental Concern that are Allergens Known to Cause Anaphylactic-Type Reactions and Part 3 Contaminants of Health or Environmental Concern.*

1,4-Bis(bromoacetoxy)-2-butene is currently acceptable for use in several OECD countries, including the United States and Australia. No decision by an OECD member country to prohibit all uses of 1,4-bis(bromoacetoxy)-2-butene for health or environmental reasons has been identified as of October 15, 2013.

8.0 Proposed Re-evaluation Decision

After a re-evaluation of the antimicrobial active ingredient, 1,4-bis(bromoacetoxy)-2-butene, Health Canada's PMRA, under the authority of the *Pest Control Products Act*, is proposing continued registration of products containing 1,4-bis(bromoacetoxy)-2-butene for the sale and use in Canada. As a condition of the continued registration, new risk-reduction measures must be included on the commercial product label. No additional data are being requested at this time.

The labels of Canadian end-use product must be amended to include the label statements listed in Appendix II. A submission to implement label revisions will be required within 90 days of finalization of the re-evaluation decision.

9.0 Supporting Documentation

PMRA documents, such as Regulatory Directive DIR2001-03, and DACO tables can be found on the Pesticides and Pest Management portion of Health Canada's website at healthcanada.gc.ca/pmra. PMRA documents are also available through the Pest Management Information Service. Phone: 1-800-267-6315 within Canada or 1-613-736-3799 outside Canada (long distance charges apply); fax: 613-736-3798; e-mail: pmra.infoserv@hc-sc.gc.ca.

The federal TSMP is available through Environment Canada's website at www.ec.gc.ca/toxiques-toxics/default.asp.

Assessments for 1,4-bis(bromoacetoxy)-2-butene are available from the United States Environmental Protection Agency at www.regulations.gov.

List of Abbreviations

a.i.	active ingredient
bw	body weight
CAS	Chemical Abstracts Service
DACO	data code
g	gram(s)
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram(s)
K_{ow}	*n*-octanol–water partition coefficient
mg	milligram(s)
mm Hg	millimetre mercury
MOE	margin of exposure
MRL	maximum residue limit
nm	nanometre
PMRA	Pest Management Regulatory Agency
PRVD	Proposed Re-evaluation Decision
RVD	Re-evaluation Decision
TSMP	Toxic Substances Management Policy
USEPA	United States Environmental Protection Agency
UV	ultraviolet
w/w	weight/weight ratio

Appendix I Registered Products Containing 1,4-Bis(bromoacetoxy)-2-butene as of 17 March 2014

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee (W/W)[1]
16779	Commercial	Buckman Laboratories of Canada Ltd.	Busan 1210 Liquid Microbicide	Solution	80%
25758	Technical	Buckman Laboratories of Canada Ltd.	BBAB Technical Liquid Microbicide	Solution	95%

[1] w/w = weight/weight ratio

Appendix II Label Amendments for the Product Containing 1,4-Bis(bromoacetoxy)-2-butene

The label amendments presented below do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements, and supplementary protective equipment. Additional information on labels of currently registered products should not be removed unless it contradicts the following label statements.

The following label statements to further protect human health and the environment are proposed to be included on the commercial end-use product label.

I) The guarantee expression on the **PRIMARY PANEL** "1,4-Bis(bromoacetoxy)-2-butene" to be replaced with "BBAB (mixed Bromoacetic acid Esters of 2-Butene-1,4-diol)" to match the Statement of Product Specification Form.

II) The following statements are proposed to be included in a section entitled **PRECAUTIONS:**

Wear chemical resistant coveralls over long-sleeved shirt and long pants, protective eyewear (goggles or face shield), and chemical-resistant gloves when handling the concentrate, while coming in contact with the treated process water, and during clean up, maintenance, and repair activities. In addition, wear a respirator with a NIOSH/MSHA/BHSE approved organic-vapour-removing cartridge with a pre-filter approved for pesticides or a NIOSH/MSHA/BHSE approved canister approved for pesticides if the area is not well ventilated and during clean-up, maintenance, and repair activities.

III) The following statements are proposed to be included in a section entitled **ENVIRONMENTAL HAZARDS:**

This product is TOXIC to aquatic organisms. It is not to be used in circumstances that would cause or allow it to enter lakes, streams, ponds, estuaries, oceans or other waters in contravention of federal or provincial regulatory requirements. The requirements of applicable laws should be determined before using the product.

IV) The following statements are proposed to be included in a section entitled **DIRECTIONS FOR USE:**

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

DO NOT discharge effluents containing this product into sewer systems, lakes, streams, ponds, estuaries, oceans, and other waters unless the effluent has been detoxified by suitable means.

References

A. Information Considered in the Chemistry Assessment

List of Studies/Information submitted by the Applicant/Registrant (Unpublished)

PMRA No.	Reference
1709894	1994, Bis-BUI-1 1994-07-01 Part 2. Specifications and Analytical Methodology Required for Registration of the Active Ingredient, BBAB, DACO: 2.99
1709359	1994, Bis-BUI-1 1994-09-09 BBAB-Determination of the N-Octanol/Water Partition Coefficient., DACO: 2.14.11
1708813	1994, Bis-BUI-1 1994-09-12 BBAB - Determination of Vapor Pressure. Amended Final Report , DACO: 2.14.9
1709435	1994, Bis-BUI-1 1994-08-29 BBAB-Determination of the Solubility in Water and Selected Solvents. Final Report, DACO: 2.99

B. Information Considered in the Human Health Risk Assessment

List of Studies/Information submitted by the Applicant/Registrant (Unpublished)

PMRA No.	Reference
1159217	1994, An Acute Oral Toxicity Study in Rats with BBAB, DACO: 4.2.1
1159218	1994, An Acute Dermal Toxicity Study in Rabbits with BBAB, DACO: 4.2.2
1159220	1994, BBAB: Salmonella Plate Incorporation Mutagenicity Assay (Ames Test) with a Confirmatory Assay, DACO 4.5.4
1159221	1994, BBAB: L5178/TK+/- Mouse Lymphoma Mutagenesis Assay with a Confirmatory Assay, DACO:4.5.4
1159222	1994, BBAB: Micronucleus Cytogenetic Assay In Mice, DACO: 4.5.4

C. Information Considered in the Environmental Risk Assessment

Studies/Information Submitted by Applicant/Registrant (Unpublished)

PMRA No.	Reference
1169296	1995, Hydrolysis of 1,4-Bisbromoacetoxy-2-Butene in Buffered Aqueous Solutions, DACO 8.2.3.2
1169297	1988, (Cis-1,4-Bis(bromoacetoxy)-2-butene) Hydrolysis, DACO:8.2.3.2
1159223	1994, BBAB-Determination of Vapor Pressure. Draft Report, , DACO: 8.2.1
1159225	1994, BBAB-Determination of the Solubility in Water and Selected Solvents, DACO: 8.2.1
1159226	1994, BBAB-Determination of the N-Octanol/Water Partition Coefficient., DACO: 8.2.1
1172524	1994, BBAB-Determination of Vapor Pressure. Amended Final Report., DACO: 8.2.1

1159232	1994, BBAB-Acute Toxicity to Daphnids (Daphnia Magna) Under Flow-Through Conditions, DACO: 9.3.1
1159233	1994, BBAB-Acute Toxicity to Rainbow Trout (Oncorhynchus Mykiss) Under Flow-Through Conditions, DACO: 9.5.2.1
1159234	1994, BBAB-Acute Toxicity to Bluegill Sunfish (Lepomis Macrochirus) Under Flow-Through Conditions, DACO: 9.5.2.1
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